

Honeywell's **HercuLine® 2000** series actuators are available in four versions: **HercuLine® 2000**, **HercuLine® 2001**, **HercuLine® 2002**, and **HercuLine® 2003**. All are low torque, precision electric rotary actuators. This guide provides you with mechanical and electrical installation information required to mount and connect the HercuLine® 2000 Series Actuator to your specific application. Installation considerations, electrical and safety precautions should be observed.

WARNING

An external disconnect switch must be installed to break all current carrying conductors connected to the actuator. Turn off power before working on conductors. Failure to observe this precaution may result in serious personal injury.

Refer to the Model Selection Guide on Pages 9 and 10 to determine which features and functions are on your model.

For additional information, refer to *HercuLine Series 2000 Installation/Operation Manual # 62-86-25-10*

Overview

The procedures to install the HercuLine® 2000 Series actuator and place it in service require that you:

1. Select a suitable location for installation.
2. Mount the actuator securely.
3. Install mechanical connections or linkage between control arm and final control element. Use HAL software application to aid in mechanical installation.
4. Make all electrical connections for actuator according to local and national electrical codes.
5. Power up actuator.
6. Enter, verify and adjust set up parameters for proper operation.
7. Check the operation of the Actuator

1. Installation Considerations

Mount the actuator in a location where it will be easily accessible for maintenance and for manual operation by means of the hand wheel. The exact location must be determined in accordance with the linkage used.

2. Actuator Mounting

Firmly bolt the actuator to a mounting surface that will not distort when subjected to the torque stresses generated by the actuator. The output shaft of the actuator should be parallel to the output shaft of the driven device. The output shaft crank arm is fully adjustable through 360°.

3. Linkage Set-up

Many applications require the use of a linkage assembly and often the final control element does not have a linear torque curve. The actuator linkage can be set up to achieve an optimal delivered torque distribution for specific applications. To assist with linkage design, Honeywell offers a linkage analysis software application (HAL). The software can be ordered as P/N 51197910-001.

Constant Torque Linkage (typical)

A constant torque linkage is employed when it is desired to provide a linear torque profile throughout the full range of final control element travel. In this situation, the actuator and driven crank arms will be set-up proportionally with respect to each other.

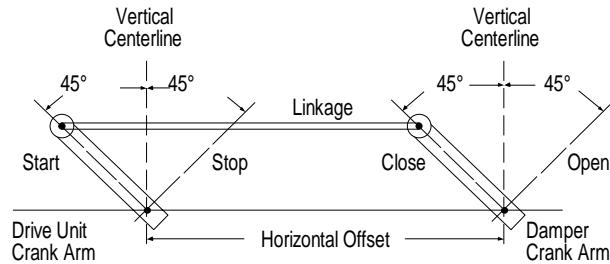


Figure 1 Constant Torque Linkage

3. Linkage Set-up (continued)

Variable Torque Linkage

A variable torque linkage is employed when it is desired to provide a non-linear torque profile throughout the full range of final control element travel. In this general situation, the actuator and driven crank arms will be set up to provide a higher torque for seating or unseating the final control element.

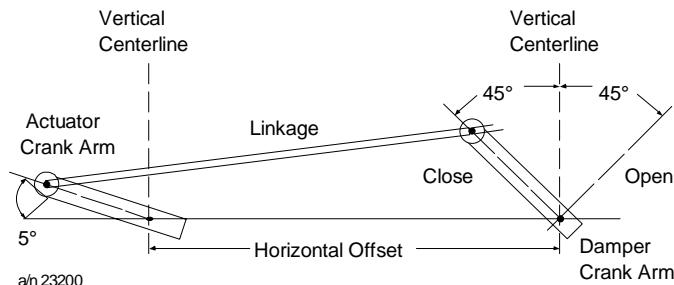


Figure 2 Variable Torque Linkage

4. Electrical Connections

The actuator terminal connections for the field wiring are located behind the cover on the actuator case. Power and field wiring is brought into the actuator through two access holes located on the side of the actuator case.

CAUTION

Use both openings: one for low level wiring (control signal) and the other for high level wiring (120Vac).

Do not run both the High Level and Low Level wiring through the same opening.

Recommended Minimum Wire Size

In general, copper wire used unless locally applicable codes dictate otherwise.

Earth ground wire to common power supply **-14AWG**

Earth ground wire to single actuator. 120/240 Vac line leads. +24 V and common signal leads. Common signal leads, relays, and aux switches – **18AWG**

HercuLine® 2000 Wiring Connections

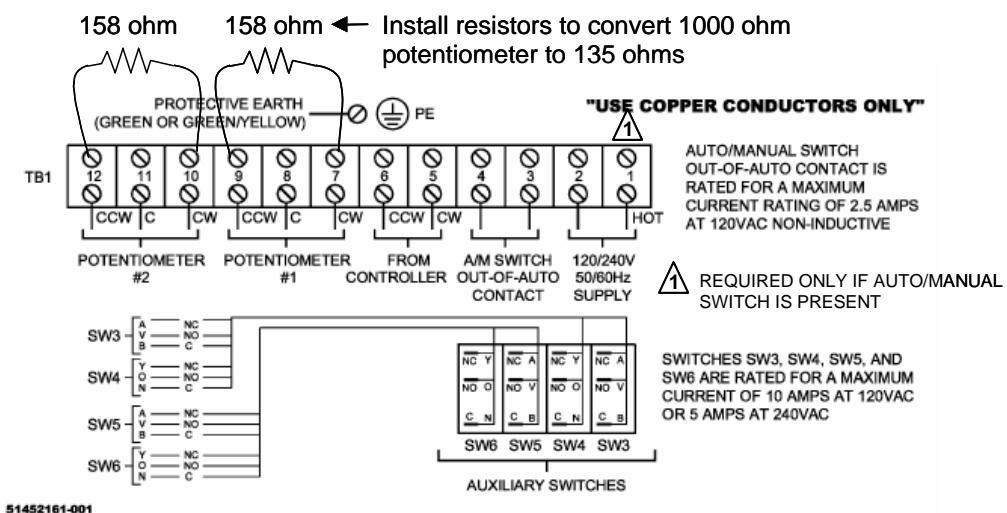
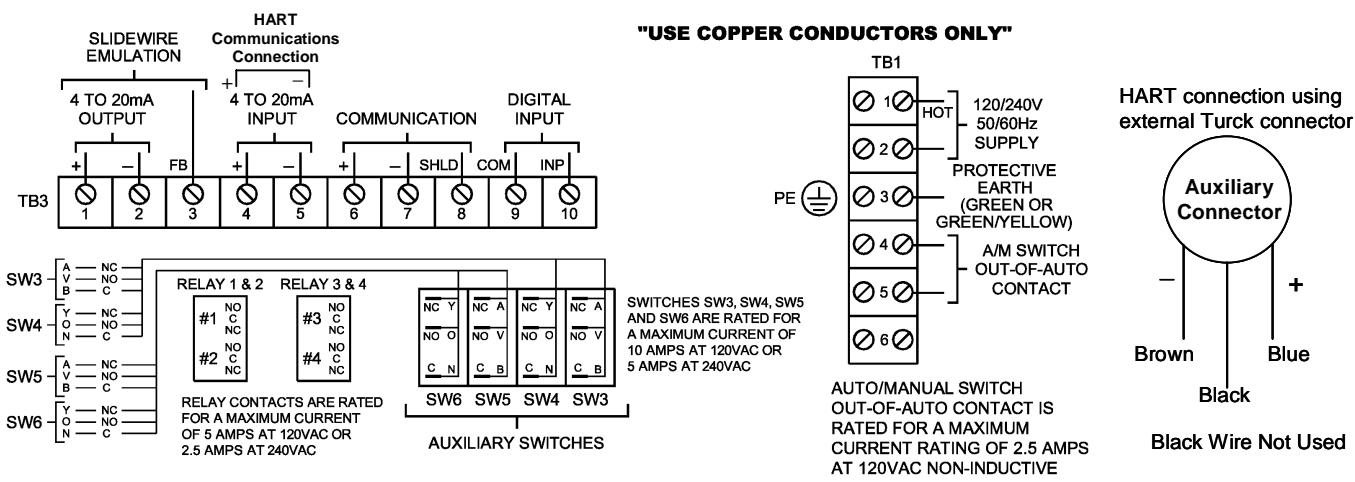


Figure 3 Herculine® 2000 connections

Connection	Terminal	Description
Hot	1	Hot wire for 120/240VAC main supply. NOTE: Use only if Auto/Manual switch is present.
Neutral	2	Neutral wire for 120/240VAC main supply
Auto/Manual Switch Contact	3	Switch contact to indicate setting of actuator AUTO/MANUAL switch.
	4	Switch is closed when actuator is "NOT-IN-AUTO"

CW from Controller	5	CW Motor Drive
CCW from Controller	6	CCW Motor Drive
Potentiometer #1	7 8 9	Clockwise-End Slidewire feedback Counterclockwise-End
Potentiometer #2	10 11 12	Clockwise-End Slidewire feedback Counterclockwise-End
Protective Ground		Ground wire connection for main supply

HercuLine® 2001/2002 Wiring Connections

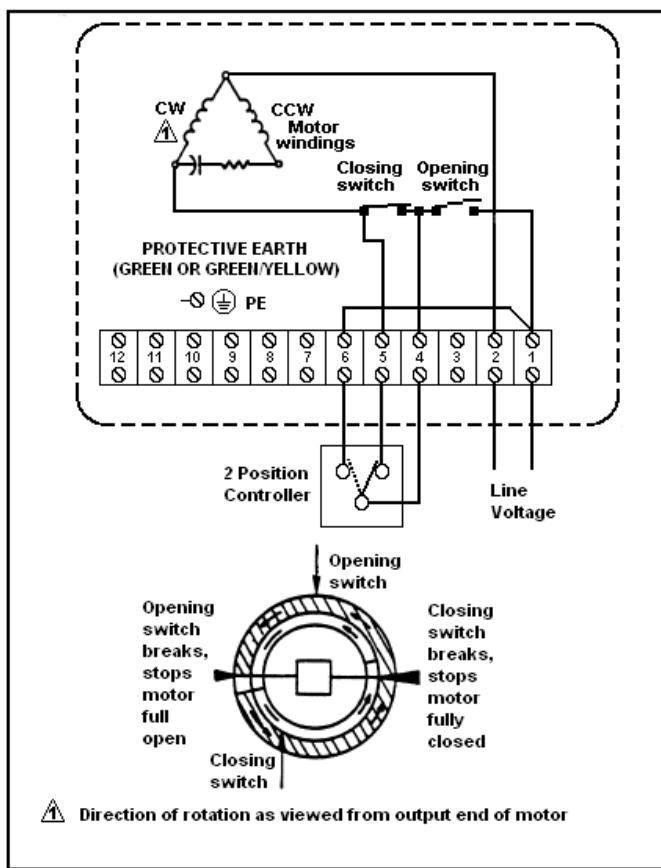


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Figure 3 Herculine® 2001/2002 Connections

Connection	Terminal	Description
	TB1	
Hot	1	Hot wire for 120/240VAC main supply
Neutral	2	Neutral wire for 120/240VAC main supply
Protective Ground	3	Ground wire connection for main supply
Auto/Manual Switch Contact	4 5	Switch contact to indicate setting of actuator AUTO/MANUAL switch. Switch is closed when actuator is "NOT-IN-AUTO"
	6	
	TB3	
4 to 20mA Output*	1 (+) 2 (-)	Analog signal output
Feedback	3	Feedback signal used in conjunction with 4 to 20mA OUTPUT voltage when using Slidewire Emulation
4 to 20mA Input	4 (+) 5 (-)	Analog signal input
Modbus Communication	6 (+) 7 (-) 8 Shield	Connection for RS485 Modbus loop wires
HART Communications	4 (+) 5 (-)	HART Communication is 4-20 mA only.
Digital Input	9 Com 10 Input	Customer's contact closure

* Optional

4. Electrical Connections (continued)**HercuLine® 2003 Wiring Connections****Figure 5 HercuLine® 2003 Wiring Connections****HercuLine® 2003 Operation**

The 2003 actuator is uni-directional (it does not reverse rotation with a reversal in control action). Figure 5 illustrates the internal wiring and the external connections.

The smaller insert of the figure describes the limit switch action for one complete cycle. When the two-position controller detects a sufficient fall in temperature in a heating application, the switch portion between the "4" and "5" terminals will close.

The motor then rotates for 180° or until the opening switch breaks (stops are adjustable, factory set at 180°), and stops in full open position.

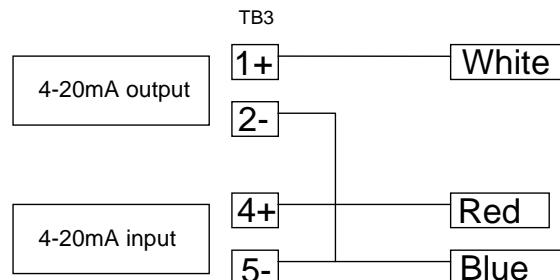
A subsequent rise in temperature causes the controller to close the switch between the "4" and "6" terminals when the motor will start to rotate (in the same direction) for 180° or until the closing switch breaks.

The motor stops in the closed position and completes one cycle.

Series 90 Control – HercuLine® 2001 model only

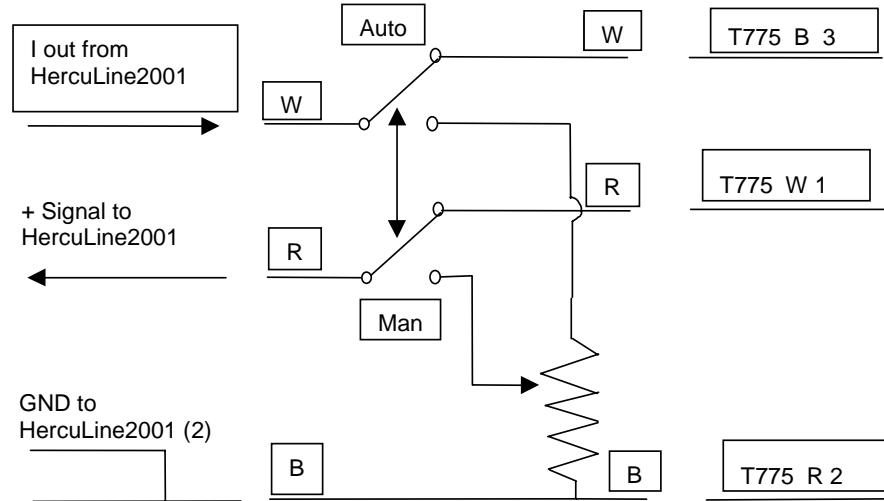
Series 90 Controls are commonly used in building environmental systems and flame safeguard systems to provide modulating control. The control is affected by balancing a 135 ohm potentiometer. The HercuLine 2001 provides an emulation of this system as follows. The current output is used to excite the potentiometer in the controller. To do this it is set permanently at 11 mA. This produces a 1.5 volt span. The wiper is then connected to the HercuLine 2001 input, which is operating in voltage mode. The returns from both the input and the output are tied together.

Series 90 terminals are typically color coded white, red and blue. Conventionally, red is the wiper and white and blue are the two ends of the potentiometer. On a drop in temperature, the wiper moves toward the blue terminal.

Connections**Figure 6 Series 90 connections**

Considerations

1. This connection performs an emulation of a series 90 motor. If the controller being used is also an emulation of a Series 90, the connections required may be different. Shown in Figure 7 are the connections found necessary to connect a T775 controller through an S443A S90 Auto/Manual Control. If the controller has the capability to provide a 4/20 or voltage output, it is easier to use that mode. It will require only two wires and it will allow the independent use of the 4/20 output. If help is required, contact Honeywell.
2. Due to variations in the definition of rotation directions, it may be necessary to reverse the action of the actuator from CCW to CW or vice versa.

**Figure 7 T775 Controller connections**

3. In the T775 controller manual there are several examples of using resistances or potentiometers as high and low limit controls. Because of the mode of emulation of Series 90, it is likely that these connections will not work as intended. Instead, use the output or input limits which are programmable in the Herculine® 2001.

5. Power up actuator.

Depending on which power supply selection is ordered for your actuator, wire the power input (MAIN POWER) as described in the previous tables and figures. Wiring must conform to national and local electrical codes.

6. Enter, verify and adjust set up parameters for proper operation. (2001/2002 with optional display)

Pressing the SET UP key on the keypad provides access to the various set up groups and allows you to set up operating parameters, (such as input types and alarms), set communications, and check actuator status. The Table below lists the set up groups that are available by using the SET UP and FUNCTION keys on the keypad.

Setup Groups	Function Prompts							
INPUT	IN TYP INP HI INP LO FILTYP Direct Dband FSTYPH FsVALH							
	FSTYPL FsVALL CHAR CUSTOM X0 VAL ... X20 VAL							
	Y0 VAL ... Y20 VAL							
RELAYn	RTYPn Rny VAL Rny E* Rny HL RTYPn Rny VAL Rny E*							
	Rny HL RLYnHY n = 1,2,3 or 4 y = 1 or 2							
CUROUT	CUROUT							
COMM	COMM ADDRES BAUD XmtDLY DBLBYT							
DIGINP	DIGINP EndPos							
DISPLA	DECIMAL EUNITS UNITS							
LOCK	LOCKID LOCK MAENAB							
STATUS	FAILSF RAMTST SEETST CFGTST CALTST							
DRVINF	VERSON SPEED POWER ROTATE TAG MFGDAT							
	LREP LCAL REPTYP							
MAINT	TEMP TEMPHI TEMPLO ACSTAL STARTS RL1CNT							
	RL2CNT RL3CNT RL4CNT REGN0 ... REGN9 TOTDEG							
	DATSAV PASSWD MANRST LD CAL LD CFG RESTRT							

You can use this procedure to access the set up groups and select all parameters.

Set Up Procedure Using Display and Keypad

Step	Operation	Press	Result
1	Enter Set Up Mode	SET UP	<i>Upper Display = SET UP-Lets you know you are in the set up mode and a set up group title is being displayed in the lower display.</i> <i>Lower Display = INPUT-This is the first set up group you see when you press SET UP.</i>
2	Select any Set Up Group	SET UP	Successive presses of the SET UP key will display the other set up group titles. You can also use the ▲ or ▼ keys to scroll through the set up groups in both directions. Stop at the set up group title that describes the group of parameters you want to configure. Then proceed to the next step.
3	Select a Function Parameter	FUNCTION	<i>Upper Display - Shows the current value or selection for the function prompt in the selected set up group.</i> <i>Lower Display - Shows the first function prompt within the selected set up group.</i>

Step	Operation	Press	Result
4	Select other function parameters	FUNCTION	Successive presses of the FUNCTION key will sequentially display the other function prompts of the selected set up group. Stop at the function prompt that you want to change, and then proceed to the next step.
5	Change the Value or Selection	▲ or ▼	These keys increase or decrease the value, or display the next available selection for the selected function prompt. Change the value or selection to meet your needs. NOTE: If the display flashes, you are trying to make an unacceptable entry, or the value on the display is at its range limit. The display may also show "KEYERR" (Key error).
6	Enter Value or Selection	FUNCTION or SET UP	This key selects another function prompt. This key selects another set up group. NOTE: Pressing either key will cause the previously selected value or selection to be entered into memory.
7	Exit Set Up mode	DISPLAY	Exits set up mode and returns actuator to the same state it was in immediately preceding entry into the set up mode. Any changes you have made are stored in memory. If you do not press any keys for 30 seconds, the display times out and reverts to the mode and display shown prior to entering the set up mode.

Record your selections on the Configuration Record Sheet

Configuration Record Sheet

Group Prompt	Function Prompt	Value or Selection	Factory Setting
INPUT	IN TYP		From MSG
	INP HI		100
	INP LO		0.0
	FILTYP		LPAS
	LPFILT		0.5
	DIRECT		CCW
	DBAND		0.5
	FSTYPH		UP
	FSVALH		100
	FSTYPL		DOWN
	FSFVALL		0
	CHAR		LINR
	CUSTOM		EQL
	X1 VAL		5
	X2 VAL		10
	X3 VAL		15
	X4 VAL		20
	X5 VAL		25
	X6 VAL		30
	X7 VAL		35
	X8 VAL		40
	X9 VAL		45
	X10 VAL		50
	X11 VAL		55
	X12 VAL		60
	X12 VAL		65

Group Prompt	Function Prompt	Value or Selection	Factory Setting
INPUT (CONT)	X14 VAL		70
	X15 VAL		75
	X16 VAL		80
	X17 VAL		85
	X18 VAL		90
	X19 VAL		95
	X20 VAL		100
	Y1 VAL		5
	Y2 VAL		10
	Y3 VAL		15
	Y4 VAL		20
	Y5 VAL		25
	Y6 VAL		30
	Y7 VAL		35
	Y8 VAL		40
	Y9 VAL		45
	Y10 VAL		50
	Y11 VAL		55
	Y12 VAL		60
	Y13 VAL		65
	Y14 VAL		70
	Y15 VAL		75
	Y16 VAL		80
	Y17 VAL		85
	Y18 VAL		90
	Y19 VAL		95
	Y20 VAL		100

Group Prompt	Function Prompt	Value or Selection	Factory Setting
RELAYn	RTYP		NONE
	RnyE		X1
	RnyVAL		0.0
	RnyHL		LO
	RLYnHY		0.0
CU OUT	CUROUT		NONE Depends on MSG
COMM	COMM		DIS
	ADDRES		1
	BAUD		19.2
	XmtDLY		20ms
	DBLBYT		FP B
DIGINP	DIGINP		NONE
	EndPos		0
DISPLA	DECIMAL		8888
	EUNITS		PCNT
	UNITS		ENGL
LOCK	LOCKID		0
	LOCK		NONE
	MAENAB		ENAB
STATUS	FAILSF	Read Only	Read Only
	RAMTST	Read Only	Read Only
	SEETST	Read Only	Read Only
	CFGST	Read Only	Read Only
	CALTST	Read Only	Read Only
DRVINF	VERSON	Read Only	Read Only
	SPEED	Read Only	Read Only
	POWER	Read Only	Read Only
	ROTATE	Read Only	Read Only
	TAG		6 alpha characters
	MFGDAT	Read Only	Read Only
	LREP	Factory Set	Factory Set
	LCAL	Factory Set	Factory Set
	REPTYP	Factory Set	Factory Set

Group Prompt	Function Prompt	Value or Selection	Factory Setting
MAINT	TEMP		NONE
	TEMPHI		X1
	TEMPLO		0.0
	hh:mm:ss	ACST	Read Only
	STARTS	Read Only	Accumulated Motor Starts
	RnCNT n=1,2,3,or4	Read Only	Relay Cycle Counts
	REGNn n= 0 to 9	Read Only	Accumulated Motor Starts
	TOTDEG	Read Only	Total Degrees of Motor Travel
	DATSAV		DIS
	PASSWRD		Nnnn
	MANRST		NONE
	LD CAL		NONE
	LD CFG		DIS
	RESTR		DIS

7. Start up/Operation

After the actuator is completely installed, wired, and the preliminary adjustments made, check the operation of the actuator and controlled device before placing it in service. Operate the controlled device and check its direction of travel in response to an increase of the input signal and make sure it is correct for the process. Actuators having the optional auto-manual switch must have the knob set in the AUTO position.

When power is applied to the actuator, the actuator electronics performs a diagnostic routine on various device components. These tests include a:

- RAM diagnostic (RAMTST),
- Check of the electrically eraseable PROM (SEETST),
- Verification that valid parameter values are in the actuator configuration (CFGST),
- Verification of valid calibration values (CALTST)
- Test of the local display and LED indicators (all display segments and LED indicators light simultaneously).

The optional local display shows the status of the diagnostics as they are completed during power up. TEST DONE is shown on the display when diagnostics are complete and actuator should be in AUTO mode.

If the Actuator Motor is "Hunting" (Motor does not drive to a position and stop) the process control loop is not tuned correctly. Refer to the Instruction Manual for your controller on how to tune a loop.

Model Selection Guide

Instructions

- Select the desired key number. The arrow to the right marks the selection available.
- Make the desired selections from Tables I thru VIII using the column below the arrow.

A dot (•) denotes unrestricted availability.

Key Number	I	II	III	IV	V	VI	VII	VIII	IX
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KEY NUMBER - Motor Selection

	Selection	Availability
Basic Motor Unit (no electronics)	2000	↓
Basic Motor Unit plus Digital Electronics	2001	↓
Enhanced Performance Motor Unit with Non-contact Position Sensing	2002	↓
Unidirectional Motor (M640D Replacement)	2003	↓

TABLE I - TORQUE & SPEED SELECTION (speed per 150 degree rotation)

Torque, lb-in/(N-M)	50Hz (90°/150°)	60Hz (90°/150°)					
50 / (6.0)	4.5 / 7.5 sec	4 / 6 sec	050	•	•	•	•
100 / (11.5)	9 / 15 sec	7 / 12 sec	100	•	•	•	•
200 / 22.5)	18 / 30 sec	15 / 25 sec	200	•	•	•	•
400 / (45.0)	36 / 60 sec	30 / 50 sec	400	•	•	•	•
400 / (45.0)	54 / 90 sec	45 / 75 sec	600	•	•	•	•

TABLE II - ROTATION

Travel	90 degrees 150 degrees 360 degrees	090 150 360	•	•	•	•	•
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TABLE III - POWER SUPPLY

Single Phase	100 - 130 Vac, 60 Hz 100 - 130 Vac, 50 Hz 200 - 240 Vac, 60 Hz 200 - 240 Vac, 50 Hz	126 125 246 245	•	•	•	•	•
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TABLE IV - ANALOG INPUT/OUTPUT SIGNALS

Input	3 Wire Drive up/down 0/4-20 mA, 0/1-5 Vdc, 0-10 Vdc 0/4-20 mA, 0/1-5 Vdc, 0-10 Vdc 0 to 135 ohm input (Series 90 control) Contact Input for 2003	0 _ _ 2 _ _ 3 _ _ 4 _ _ 6 _ _	•	•	•	•	•
Output (Note 1) (Note 1)	None Dual 1000 Ohm (1000 ohms over 150 degrees) Dual 1000 Ohm (1000 ohms over 90 degrees) Slidewire Emulation Slidewire Emulation 0/4-20mAdc (0/1-5 Vdc, 0-16 Vdc) 0/4-20mAdc (0/1-5 Vdc, 0-16 Vdc)	_ 00 _ 15 _ 19 _ 60 _ 65 _ 80 _ 85	• b c	•	•	•	•

TABLE V - SWITCH AND RELAY OUTPUTS (2 end-of-travel limit switches are standard)

Auxiliary Outputs	No Auxiliary Switches 2 Auxilliary Switches 4 Auxilliary Switches	0 _ 2 _ 4 _	•	•	•	•	•
Relay Outputs	No Relays 2 Programmable Relay Outputs 2 Programmable Relay Outputs 4 Programmable Relay Outputs	_ 0 _ 2 _ 3 _ 4	•	•	•	•	•

TABLE VI - OPTIONS

Local keypad/display	No local display interface supplied Integrally mounted local display/keypad interface	(Note 2) 0 _____ 1 _____	• • • •	• • • •
Local Auto/manual switch	No auto/manual switch Auto/manual switch with "Out of Auto Contact" Auto/manual switch with "Out of Auto Contact"	0 _____ 1 _____ 2 _____	• • •	• • •
Handwheel	No Handwheel Handwheel	0 _____ 1 _____	• • •	• • •
Certificates	None Certificate of Conformance	0 _____ 1 _____	• • •	• • •
Approvals	UL Type 4/IP66, CSA CE	(Note 4) 0 _____ 1 _____	• • •	• • •
Shipped Rotation	Counter clockwise shaft rotation on increasing signal Clockwise shaft rotation on increasing signal	0 _____ 1 _____	• • •	• • •

TABLE VII - COMMUNICATIONS/PROTOCOL

None	No communications option board or protocol	0	•			•
Modbus RTU RS485	RS-485 Modbus compliant - standard with EEU	1	•	•	•	
HART 5	HART Communications Protocol	2		•	•	

TABLE VIII - MANUALS

Standard	English	0	-	-	-	-	-
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TABLE IX - FACTORY OPTIONS

Restrictions

Restriction Letter	Available Only With		Not Available With	
	Table	Selection	Table	Selection
a	IV	_00	IV	_60, _80
b	II	150	II	090
c	II	090	II	150

ACCESSORIES

Mounting Hardware	Mounting plate adapter for Barber Colman Series MP495 Mounting plate adapter for Landis & Staefa SQM53/56 Direct Couple Valve Hardware North American Valve Retrofit Kit	51452354-501 51452354-502 51452354-503 51452354-511
Linkage Assembly	Ball joint for 5/16" dia. Pushrod Pushrod 12 in. (304,5 mm) long, 5/16 " dia. Pushrod 18 in. (457,2 mm) long, 5/16 " dia. Pushrod 24 in. 609,6 mm) long, 5/16 " dia. Pushrod 48 in. (1219,2 mm) long, 5/16 " dia.	51452354-504 51452354-505 51452354-506 51452354-507 51452354-508
HART	Turk Cable for Handheld Connection	51452352-501
Handheld Config. <i>(Note 3)</i>	HercuLink™ PC and Palm PDA Software Battery powered 232/485 converter with cable	51452354-509 51452354-510
Remote Mount Control	Remote 4-20 mA requires 135 ohm fdbk, 120V 50/60Hz Remote 4-20 mA requires 1000 ohm fdbk, 120V 50/60Hz Remote 4-20 mA requires 135 ohm fdbk, 220V 50/60Hz Remote 135 ohm input requires 135 ohm fdbk, 120V 50/60Hz	R7195A1031 R7195A1056 R7195A1064 R7195B1021
V51 Valve Kits	HercuLine 2000 V51 2.5" - 3" Valve Mounting Kit HercuLine 2000 V51 4" Valve Mounting Kit	51452354-513 51452354-514

Notes:

1. 135 ohm available by parallelling 1K potentiometer with 158 Ohm resistor (supplied).
2. Herculink™ software (pn 51452354-509), RS232/485 converter (pn 51452354-510), customer supplied Palm™ PDA running OS3.5 or higher and Palm serial cable are required for the 2001 and 2002 actuators if no display is selected.
3. Requires PDA manufacturer's serial interface cable.
4. CSA approval is good for 75°C and a maximum relay load of 3.5 amps or 70°C with a relay load of 5 amps.